

What is claimed is:

1. A non-volatile storage device comprising:

a plurality of banks; and

a control unit,

wherein the bank has a non-volatile memory unit and a buffer unit corresponding thereto,

the non-volatile memory unit of each bank can carry out an access operation independently, and

the control unit can be caused to control a first access processing between an outside and the buffer unit and a second access processing between the non-volatile memory unit and the buffer unit upon receipt of directives from the outside separately from each other,

the first access processing including an access to one buffer unit, and

the second access processing including an access to one non-volatile memory unit and an access to a plurality of non-volatile memory units and capable of being caused to select either of the accesses.

2. The non-volatile storage device of claim 1, wherein the directive of the first access processing serves to write data input from the outside to the buffer unit or to read data from the buffer unit to the outside.

3. The non-volatile storage device of claim 2, wherein the directive for writing or the directive for reading is given

by a change in one or a plurality of control signals input from the outside.

4. The non-volatile storage device of claim 3, wherein said non-volatile storage device can output, to the outside, state directive information for indicating that the second access processing is being carried out.

5. The non-volatile storage device of claim 1, wherein said directive of the second access processing is given in accordance with an access command, and has, as the access command, a first access command for giving a directive to read data from the buffer unit and to write the data to the non-volatile memory unit, a second access command for giving a directive to read the data from the non-volatile memory unit and to write the data to the buffer unit, or a third access command for giving a directive to erase the data of the non-volatile memory unit.

6. The non-volatile storage device of claim 1, wherein the control unit can recognize an address command supplied from the outside, and

the control unit recognizes a specification of a storage region of the buffer unit and a storage region of the non-volatile memory unit in accordance with an address command.

7. The non-volatile storage device of claim 6, wherein said control unit recognizes a specification of one or a plurality of the buffer units in accordance with the at least one address command, and

gives an access to one or a plurality of the non-volatile memory units corresponding to one or a plurality of the buffer units specified in accordance with the address command through the second access processing.

8. The non-volatile storage device of claim 6, wherein the address command has first specification information, second specification information and third specification information,

the first specification information specifying a non-volatile memory unit and tacitly specifying a buffer unit corresponding to the non-volatile memory unit thus specified,

the second specification information specifying an accessing object address in the non-volatile memory unit which is specified, and

the third specification information specifying an accessing object address of the buffer unit which is specified.

9. The non-volatile storage device of claim 8, wherein the control unit regards a specification of the buffer unit based on the first specification information as a specification of another buffer unit which does not correspond to the non-volatile memory unit when responding to a specific directive of the second access processing.

10. The non-volatile storage device of claim 1, wherein the control unit can carry out the second access processing of the non-volatile memory unit and the first access processing of another buffer unit which does not correspond to the

non-volatile memory unit at the same time.

11. The non-volatile storage device of claim 1, wherein the control unit can carry out an erase processing of the non-volatile memory unit and the first access processing of the buffer unit at the same time.

12. The non-volatile storage device of claim 1, wherein the control unit maintains storage information of the buffer unit in such a state as to carry out a processing of responding to a directive of the second access processing of reading data from the buffer unit and writing the data to the non-volatile memory unit and to then wait for another directive of the first access processing or the second access processing.

13. The non-volatile storage device of claim 1, wherein the control unit maintains storage information of the buffer unit in such a state as to carry out a processing of responding to a directive of the first access processing of reading data from the buffer unit and outputting the data to an outside and to then wait for another directive of the first access processing or the second access processing.

14. The non-volatile storage device of claim 11, wherein the control unit initializes storage information of a buffer memory unit in accordance with a buffer clear command.

15. The non-volatile storage device of claim 12, wherein the control unit initializes storage information of the buffer unit before writing data input from the outside to the buffer

unit in response to the first access processing when writing the same data.

16. The non-volatile storage device of claim 1, wherein the control unit can transfer data read from the non-volatile memory unit and written to the buffer unit through the second access processing at plural times in a different timing from the buffer unit to the outside through the first access processing to be carried out at plural times.

17. The non-volatile storage device of claim 1, wherein the control unit omits a second access processing of writing data from the non-volatile memory unit to the buffer unit which sets the same address as that on the non-volatile memory unit of data retained in the buffer unit to be an access processing object when a directive of the second access processing is given.

18. The non-volatile storage device of claim 17, further comprising address holding means for holding address information about an address on the non-volatile memory unit of the data retained in the buffer unit, and comparing means for comparing the address information held in the address holding means with address information about an address of the non-volatile memory unit which is set to be a data reading object in the second access processing.

19. The non-volatile storage device of claim 17, wherein the control unit varies a period of a busy state based on a signal indicating, as the busy state, that the second access

processing is being carried out depending on presence of the omission of the second access processing when a directive for outputting data written from the non-volatile memory unit to the buffer unit in the second access processing from the buffer unit to the outside is given through the first access processing.

20. The non-volatile storage device of claim 1, wherein the control unit can write data written from the outside to the buffer unit by the first access processing at plural times from the buffer unit to the non-volatile memory unit through the second access processing carried out at plural times.

21. The non-volatile storage device of claim 1, wherein the control unit can write data rewritten from the outside onto the buffer unit by the first access processing carried out at plural times from the buffer unit to the non-volatile memory unit through the second access processing.

22. The non-volatile storage device of claim 1, wherein the non-volatile memory unit can store multivalued information of 2 bits or more in one storage element and the buffer unit can store binary information of 1 bit in one storage element.

23. The non-volatile storage device of claim 22, wherein the control unit can regard storage information of the non-volatile memory unit as binary information and can control a third access processing of omitting a converting operation from a multivalue to a binary.

24. The non-volatile storage device of claim 5, further

comprising, on a signal path to be used for the first access processing, an address buffer for latching address information sent from the outside, a buffer unit address buffer for inputting an output of the address buffer and supplying the output to the buffer unit, a buffer unit data buffer for latching data output from the buffer unit, and a data buffer for latching data output from the buffer unit data buffer and outputting the data to the outside,

the control unit generating, as a dummy clock, a latch timing of the buffer unit address buffer and a latch timing of the buffer unit data buffer while an address command is recognized synchronously with a first strobe signal and a second strobe signal for giving a directive to read data to the outside in the first access processing is then changed.

25. The non-volatile storage device of claim 1, wherein the non-volatile memory unit has an erase unit which is plural times as large as a write unit and each of the buffer units has a storage capacity on the write unit, and

the control unit uses both the buffer unit of a bank to be a rewrite object and the buffer unit of a different bank in a save region of rewrite object storage information corresponding to a directive of a rewrite operation for storage information on the erase unit.

26. The non-volatile storage device of claim 1, wherein said non-volatile storage device is formed on one semiconductor

chip.

27. The non-volatile storage device of claim 1, further comprising another circuit module is wholly formed on one semiconductor chip.

28. A non-volatile storage device comprising:

a plurality of memory banks; and

a control unit,

the memory bank having a non-volatile memory unit and a buffer unit,

accessing object regions of the buffer unit and the non-volatile memory unit being specified based on an address command, and

the control unit being capable of controlling a first access processing of carrying out an access operation between an outside and the buffer unit and a second access processing of carrying out an access operation between the non-volatile memory unit and the buffer unit upon receipt of directives from the outside separately from each other, and controlling one of the first access processing corresponding to one of the second access processing and controlling a plurality of the first access processings corresponding to one of the second access processing.

29. The non-volatile storage device of claim 28, wherein the control unit is caused to utilize the buffer unit of the memory bank specified in accordance with the address command



in the first access processing, and

is caused to utilize the buffer unit of the memory bank specified in accordance with the address command or the buffer unit of another memory bank corresponding to contents of a directive in the second access processing.

30. The non-volatile storage device of claim 28, wherein the control unit controls a read set-up operation for the accessing object region of the non-volatile memory unit specified in accordance with an address command every time the address command is input within a limit of the number of times of a dependence on the number of the memory banks, and controls to read storage information from the non-volatile memory unit subjected to the read set-up and to write the storage information to the buffer unit when a read access command for giving a directive of a read operation as the second access processing is input.

31. The non-volatile storage device of claim 28, wherein the control unit controls a write operation for write data to the buffer unit of the memory bank specified in accordance with an address command every time the address command is input and write data are input in accordance with a directive of the first access processing continuously within a limit of the number of times of a dependence on the number of the memory banks, and carries out a control to write the write data possessed by the buffer unit to the non-volatile memory unit of the

corresponding memory bank when a write access command for giving a directive of the write operation as the second access processing is input.

32. The non-volatile storage device of claim 28, wherein the control unit controls an erase operation of a storage region for the non-volatile memory unit of the memory bank specified in accordance with an address command by inputting the address command and then inputting an erase command continuously within a limit of the number of times of a dependence on the number of the memory banks.

33. A non-volatile storage device comprising:

a control unit;

a non-volatile storage unit; and

a buffer circuit,

the non-volatile storage unit being divided into a plurality of non-volatile storage regions,

the buffer circuit being divided into a plurality of buffer regions corresponding to the non-volatile storage regions,

the control unit accepting a plurality of operation directive commands from an outside, the operation directive commands having:

a first operation directive command for giving a directive of an access operation between the buffer circuit and the outside; and

a second operation directive command for giving a

directive of an access operation between the buffer circuit and the non-volatile storage unit,

the first operation directive command giving a directive of an access operation to the buffer region, and

the second operation directive command capable of selecting either an access operation to the non-volatile storage region or an access operation to the non-volatile storage regions.

34. The non-volatile storage device of claim 33, wherein the control unit has a command accepting state capable of accepting the operation directive command, and accepts the operation directive command to carry out a processing corresponding to each operation directive command and then brings the command accepting state.

35. The non-volatile storage device of claim 34, wherein the operation directive command is a third operation directive command for specifying an address to select the non-volatile storage region, and

the second operation directive command gives a directive to carry out an access operation between the non-volatile storage region which is selected in accordance with the third operation directive command and the buffer circuit.

36. The non-volatile storage device of claim 35, wherein the control unit selects the non-volatile storage region in accordance with the third operation directive command and also

selects the buffer region corresponding to the non-volatile storage region thus selected,

the first operation directive command gives a directive for carrying out an access operation between the buffer region selected in accordance with the third operation directive command and the outside, and

the second operation directive command gives a directive for carrying out an access operation between the buffer region and the non-volatile storage region which are selected in accordance with the third operation directive command.

37. The non-volatile storage device of claim 36, wherein the control unit is brought into the command accepting state corresponding to a completion of a part of the access processing to the non-volatile storage region in accordance with the second operation directive command, and

before all the access processings to the non-volatile storage region are completed, can carry out

an acceptance of the third operation directive command, and

an acceptance of the first or second operation directive command when the buffer region and the non-volatile storage region which are selected in accordance with the third operation directive command are different from the region in which the access processing is carried out.

38. The non-volatile storage device of claim 37, wherein

the first operation directive command includes a first write operation command for giving a directive to write data to the buffer circuit and a first read operation command for giving a directive to read data from the buffer circuit, and

the second operation directive command includes a second write operation command for giving a directive to write data from the buffer circuit to the non-volatile storage unit and a second read operation command for giving a directive to read data from the non-volatile storage unit to the buffer circuit.

39. The non-volatile storage device of claim 38, wherein the first operation directive command further includes a first erase operation command for giving a directive to erase data written to the buffer circuit, and the second operation directive command further includes a second erase operation command for giving a directive to erase data written to the non-volatile storage unit.

40. The non-volatile storage device of claim 39, wherein after accepting the third operation directive command for specifying a first non-volatile storage region of the non-volatile storage unit and then accepting the second erase operation command, and starting to erase data written to the first non-volatile storage region and before completing the erase of the data,

the control unit can accept the third operation directive command for specifying a second non-volatile storage region

of the non-volatile storage unit and the first operation directive command or the second operation directive command.

41. The non-volatile storage device of claim 39, wherein after accepting the third operation directive command for specifying a first non-volatile storage region of the non-volatile storage unit and then accepting the second read command, and completing to read data from the non-volatile storage unit to the buffer circuit,

the control unit can accept the first operation directive command at least once, and furthermore, can carry out an operation for accepting the second write command.

42. The non-volatile storage device of claim 41, wherein after accepting the second read command and before accepting the second write command,

the control unit carries out an acceptance of the third operation directive command for specifying a second non-volatile storage region of the non-volatile storage unit and an acceptance of the first operation directive command or the second operation directive command at least once and can then carry out an operation for accepting the third operation directive command for specifying the first non-volatile storage region.

43. The non-volatile storage device of claim 38, wherein the control unit can carry out an operation for accepting the second write command after accepting the third operation

directive command for specifying the first non-volatile storage region of the non-volatile storage unit and then accepting the first write command at least once.

44. The non-volatile storage device of claim 43, wherein the control unit can carry out an operation for accepting the first operation directive command at least once after accepting the first write command at least once.

45. The non-volatile storage device of claim 43, wherein the control unit can carry out the operation for accepting the second write command at least once after accepting the write command at least once.

46. The non-volatile storage device of claim 39, wherein the control unit accepts the second read command after accepting the third operation directive command for specifying a first address included in the first non-volatile storage region of the non-volatile storage unit,

reads data in a first data volume from an address specified in accordance with the third operation directive command from the non-volatile storage unit to the buffer circuit in accordance with the second read command, and

can then accept, at least once, the third operation directive command and the first operation directive command which specify an address included in the first non-volatile storage region of the non-volatile storage unit and contained in a range of the first data volume from the first address.

47. The non-volatile storage device of claim 39, wherein when accepting the second read command after accepting the third operation directive command for specifying a first address included in the first non-volatile storage region of the non-volatile storage unit,

reading data in a first data volume from an address specified in accordance with the third operation directive command from the non-volatile storage unit to the buffer circuit in accordance with the second read command, and

further accepting the third operation directive command for specifying a second address included in the first non-volatile storage region of the non-volatile storage unit and contained in a range of the first data volume from the first address, and accepting the second read command,

the control unit does not carry out a read operation from the non-volatile storage unit to the buffer circuit in a processing of the second read command.

48. The non-volatile storage device of claim 39, wherein the control unit does not erase data written to the buffer circuit in a completion of the second write command but erases the data written to the buffer circuit in accordance with the first erase operation command.

49. The non-volatile storage device of claim 35, further comprising a first buffer region of a buffer circuit which preferentially corresponds to a first non-volatile storage



region and a second buffer region of a buffer circuit which preferentially corresponds to a second non-volatile storage region,

a first buffer region of the buffer circuit being capable of carrying out an access operation together with the second non-volatile storage region, and

a second buffer region of the buffer circuit capable of carrying out an access operation together with the first non-volatile storage region.

50. The non-volatile storage device of claim 49, wherein the first operation directive command includes a first write operation command for carrying out an access operation between the first buffer region of the buffer circuit and the outside to give a directive to write data to the buffer circuit, a first read operation command for giving a directive to read data from the buffer circuit, and a first erase operation command for giving a directive to erase data written to the buffer circuit, and

the second operation directive command includes a second write operation command for carrying out an access operation between the buffer region of the buffer circuit selected in accordance with the third operation directive command and the non-volatile storage region of the non-volatile storage unit to give a directive to write data from the buffer circuit to the non-volatile storage unit, a second read operation command

for giving a directive to read data from the non-volatile storage unit to the buffer circuit, and a second erase operation command for giving a directive to erase data written to the non-volatile storage unit,

the second write operation command having a main second write operation command for giving a directive to write data to the non-volatile storage region which preferentially corresponds to the buffer region of the buffer circuit which is selected, and a subordinate second write operation command for giving a directive to write data to a non-volatile storage region which is not the non-volatile storage region preferentially corresponding to the buffer region of the buffer circuit which is selected, and

the second read operation command having a main second read operation command for giving a directive to read data from the non-volatile storage region which preferentially corresponds to the buffer region of the buffer circuit which is selected, and a subordinate second read operation command for giving a directive to read data from a non-volatile storage region which is not the non-volatile storage region preferentially corresponding to the buffer region of the buffer circuit which is selected.

51. The non-volatile storage device of claim 50, wherein data are read or written at a time on a first data volume unit in accordance with the second read command or the second write

command,

data are erased at a time on a unit of a second data volume which is larger than the first data volume in accordance with the second erase command, and

when a first address is specified in accordance with the third operation directive command and a directive of the second erase command is given, first data included in an address range having the first data volume from the first address are written to the non-volatile storage region preferentially corresponding to the buffer region of the buffer circuit which is selected or/and second data sent from a second address which is not included in the address range having the first data volume from the first address are written to the non-volatile storage region which is not the non-volatile storage region preferentially corresponding to the buffer region of the buffer circuit which is selected.

52. A non-volatile storage device comprising:

a control unit;

a non-volatile storage unit;

the non-volatile storage unit having a plurality of storage regions, and

the same number of buffer circuits as the number of the storage regions,

the buffer circuits being connected to an outside and being caused to correspond to the storage regions, respectively,

the buffer circuits being capable of being accessed to the outside independently based on a control to be carried out by the control unit, respectively, and

one or a plurality of the storage regions being capable of carrying out an access operation independently together with the corresponding buffer circuit based on the control to be carried out by the control unit.

53. A non-volatile storage device comprising:

a non-volatile memory unit;

a buffer unit; and

a control unit,

the non-volatile memory unit being divided into a plurality of memory banks which can independently carry out an access operation, respectively,

the buffer unit being divided into a plurality of regions corresponding to the respective memory banks, and

the control unit being capable of independently carrying out an access control in accordance with a directive given from an outside with respect to the non-volatile memory unit and the buffer unit, and giving an access directive to one or a plurality of the regions of the buffer unit in accordance with the directive given from the outside and then carrying out an access control between the non-volatile memory unit and the buffer unit with respect to one or a plurality of the memory banks corresponding to one or a plurality of the regions.

54. A non-volatile storage device comprising:

a non-volatile memory unit;

a buffer unit; and

a control unit,

the control unit being capable of controlling a first access processing between an outside and the buffer unit, a second access processing between the non-volatile memory unit and the buffer unit, and an initialization processing of the buffer unit upon receipt of directives from the outside separately from each other, and

carrying out no initialization over the buffer unit depending on a completion of the first access processing and the second access processing but bringing the buffer unit into an initializing state depending on the initialization processing of the buffer unit.

55. The non-volatile storage device of claim 54, wherein the non-volatile memory unit has a plurality of non-volatile memory cells, each of the non-volatile memory cells having a first state indicative of an erase state and a second state indicative of a write state, and

the initializing state of the buffer unit corresponds to the first state of the non-volatile memory cell.

56. The non-volatile storage device of claim 55, wherein the non-volatile memory cell has a threshold voltage, and

the state of each of the non-volatile memory cells is

determined depending on whether a threshold voltage of the non-volatile memory cell is included in an erase voltage distribution indicative of the erase state or a write voltage distribution indicative of the write state.

57. The non-volatile storage device of claim 56, wherein the second access processing includes a data read operation from the non-volatile memory unit to the buffer unit,

the first access processing includes a data output operation from the buffer unit to the outside, and

the data output operation can be carried out at plural times after one data read operation.

58. The non-volatile storage device of claim 57, wherein the control unit carries out the initialization processing of the buffer unit before the data read operation.

59. The non-volatile storage device of claim 56, wherein the second access processing includes a data write operation from the buffer unit to the non-volatile memory unit,

the first access processing includes a data input operation from the outside to the buffer unit, and

one data write operation can be carried out after the data input operation executed at plural times.

60. The non-volatile storage device of claim 59, wherein the control unit carries out the initialization processing of the buffer unit after the data write operation.